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CHECKING THE NET CONTENTS OF PACKAGED GOODS

as adopted by the National Conference on Weights and Measures

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NIST HANDBOOK 133 – THIRD EDITION, Supplement

CHECKING THE NET CONTENTS OF PACKAGED GOODS

C. S. Brickenkamp, Editor

National Institute of Standards and Technology
Gaithersburg, MD 20899

NOTE: As of 23 August 1988, the National Bureau of Standards (NBS) became the National Institute of Standards and Technology (NIST) when President Reagan signed into law the Omnibus Trade and Competitiveness Act.

U.S. DEPARTMENT OF COMMERCE, Robert A. Mosbacher, Secretary
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY, John W. Lyons, Director

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Foreword

This supplement compiles the latest amendments adopted by the National Conference on Weights and Measures at the Annual Meetings in 1989 and 1990 and editorial corrections recommended by the U.S. Department of Agriculture and others.

The National Institute of Standards and Technology (NIST) has a statutory responsibility for "cooperation with the States in securing uniformity of weights and measures laws and methods of inspection." In partial fulfillment of this responsibility, the Institute is pleased to publish these recommendations of the National Conference.

Reason for and Use of This Supplement

Only minor additions and revisions to NIST (formerly National Bureau of Standards - NBS) Handbook 133, Third Edition, "Checking the Net Contents of Packaged Goods," were adopted by the National Conference on Weights and Measures in 1989 and 1990. A few editorial corrections were also necessary. This supplement therefore consists of change pages to the Third Edition.

A list of the changes that have been made to Handbook 133 and adopted by the Conference are listed on the next pages as "Addendum - 1990"; the change pages that follow include the editorial corrections. Please insert the "Addendum - 1990" pages in front of page v and, as appropriate, replace existing pages in the Third Edition with the change pages.

Addendum - 1990

Section	Action	Page
2.9.	Wording clarified concerning disposition of individual short weight or measure packages. See Item 240-1B in 1989 Report of the 74th NCWM.	2-18
2.11.	The definition of used tare was made consistent with the new procedures adopted for meat and poultry (Section 3.18) which permit drying in a microwave oven.	2-19
2.11.	Same as above for dried used tare	2-20
2.12.	Reference to Table 2-12 on page B-15 added.	2-25
2.12.	Reference to Table 2-12 added.	2-26
2.13.1.	References added to Uniform Packaging and Labeling Regulation Sections 10.12. and 10.13. See Item 240-3 in 1989 Report of the 74th NCWM.	2-26, 2-27
2.13.4.	Reference to Meat and Poultry Inspection Manual dropped per USDA request (manual being phased out).	2-28
3.7.	Under item (f), "by subtraction" deleted.	3-14
3.11.4.(a)	Procedure for exhausting foam products changed. See Item 240-2 in 1990 Report of the 75th NCWM.	3-30
3.18.1.	Reference changed from Section 3.18.3.5 for tare definition to Section 2.11.	3-46
3.18.1.	Reference to products for which no gray area has yet been determined was added.	3-46
3.18.1.	Figure 3-15 moved for clarity.	3-48, 3-49
3.18.2.(a)	Reference to bacon with free-flowing liquid as "subquality" was deleted.	3-50
3.18.3.(f)	References corrected from Section 3.18.3.7 to 3.18.3.g and from 3.18.3.8. to 3.18.3.h.	3-53
4.16.	Section added. See Item 232-7B in 1989 Report of the 74th NCWM.	4-43 - 4-45
4.6.4.	Method D. Determining the Net Contents of Compressed Gas Cylinders added. See Item 232-14 in 1990 Report of the 75th NCWM.	4-18 4-46 - 4-50
5.1.3.	Correct references to report forms on pages A-9 and A-10.	5-3
5.3.2.	Correct references to report forms on pages A-9 and A-10.	5-7
5.4.	Revised to recognize weight and reference Section 2.12.4. of the Uniform Method of Sale of Commodities. See Item 240-3 in 1989 Report of the 74th NCWM.	5-8 - 5-12

Section	Action	Page
Appx B	Reference to MAV for polyethylene labeled by weight added to Table 2-8.	B-9
	In Table 2-12, Group 5 Lower Limit for Individual Weights changed to 1% of labeled weight per U.S. Department of Agriculture request. Lower Limit of 1.5 oz for largest weight of 160 oz in Group 4 is equivalent to 0.94% of the labeled weight. A fixed Lower Limit of 2 oz (or 4 oz, depending upon the scale being used) in Group 5 (which can range from a labeled weight of 160 oz up) is too small as a percentage of the labeled weight for large labeled weights. For example, a Lower Limit of 2 oz for a labeled weight of 50 lb (800 oz) is equivalent to 0.25% of the labeled weight. The new Lower Limit of 1% is more equitable for large labeled weights.	B-15
Appx C	Definition of dried used tare and used tare changed to be consistent with changes made to Section 2.11. above.	C-2, C-8

In the above example, the average error is -0.30, hence the lot fails to comply with the package requirements since the value in box 18 (-0.30) disregarding its sign is larger than the value in box 26 (0.20). See Figure 2-8.

It should be remembered that the calculations in steps (i) through (v) above have to be made only when the average error is minus. See page H-3 for a complete example using a Category A sampling plan and filling out the report form.

2.8. Sampling Plans in Category B

Table 2-5 on page B-5 provides the two Category B sampling plans. Depending on the size of the lot, (**N**), shown in column 1, column 2 indicates the number of packages to be chosen at random from the lot (the "sample size", **n**) and column 3 shows the number of packages that must be opened to determine the average tare ("tare sample size"). Column 4 shows that **no (zero)** packages are permitted to exceed the MAV. On the report forms on pages A-1 or A-2, the lot size is recorded in box 5, the sample size in box 6 (check the box indicating that a Category B plan is being followed), and the tare sample size in box 7. A zero is recorded in box 8.

Obviously defective individual packages are not to be selected from the inspection lot to become part of the sample. [See Appendix E for guidance in this situation.] However, obviously defective packages should not be reintroduced into commerce.

After the quantity of contents in the sample packages is measured and recorded, it is then necessary to compare these measurements with the package requirements.

2.8.1. Decision Criterion: Individual Packages

Minus package errors that exceed the magnitude of the MAV (Section 2.12.) are called "UNREASONABLE ERRORS". Category B permits no unreasonable errors in the sample. [See Column 4 of Table 2-5.]

On the report forms on pages A-1 and A-2, the number of unreasonable errors found in the sample is recorded in box 16.

If there are any unreasonable errors in the sample, the lot fails to conform with the individual package requirement (see box 17 on the report forms). No further testing is necessary to determine lot conformance.

If there are no unreasonable errors in the sample, the total error and the average error must be calculated before making a final decision on the conformance of the lot.

2.8.2. Decision Criterion: The Average Error

The "average error" of the sample is calculated from the values obtained from individual package measurements. The average error obtained by dividing the sum of the individual package errors in the sample (called the "total error" and recorded in box 15 on the report forms) by the number of packages in the sample (box 6).

If the total error (and consequently the average error) is zero or a positive number, the lot conforms with the package requirements. If the total error (and consequently the average error) is minus, the lot fails to conform with the package requirements.

The average error is recorded in boxes 18 and 19 on the report forms. Whether the average error is a zero, plus, or minus value is recorded in box 20. See pages H-1 and H-2 for complete examples using a Category B sampling plan.

2.9. Individual Packages

In a lot complying with the package requirements as determined by either a Category A or B sampling plan, individual packages in the sample may be short weight or measure from the labeled quantity by more than the MAV. These are called "defective" packages. Enforcement action should be taken on the entire lot if the number of defective packages is greater than the allowed number in Category A (Table 2-2) or Category B (Table 2-5). No fines or other penalties should be levied for defective packages, if the number of such packages is less than the number that would require the lot to be rejected. For example, if column 4 in Table 2-2 permits 3 packages to exceed the MAV, and only 2 packages in the sample exceed the MAV, the lot would pass inspection. No fines should be levied for the two defective packages found, but those defective packages should be ordered off-sale. Defective packages should not be reintroduced into commerce.

Disposition of such packages may be recorded on the report forms on pages A-1 or A-2, under "Comments."
(Revised 1989)

2.10.The Criteria for Weighing Packages not Labeled by Weight

The preferred method for testing packages labeled in units other than weight is to weigh such packages. If the official can determine the weight of the labeled quantity of product, that weight plus the empty container weight can be used to compare with the weights of unopened packages. Otherwise, the official must open and measure the contents of every package in the sample -- a time-consuming and costly alternative.

However, two criteria must be met before the official may use a weighing technique:

(i) The equipment used must be able to discriminate differences in package content weights corresponding to the MAV/6. [Most common liquid commodities will meet this criterion; see step 1, footnote, in Section 4.4.]

If the equal-arm scales described in Section 3.1. are used, this criterion can be met if 1/2 the smallest scale division is equal to or smaller than MAV/6. If a digital-readout scale is used, the smallest increment in the readout must not be larger than the MAV/6.

(ii) The weight of a known quantity of product must not vary significantly from package to package. [See Section 4.4. for liquid volume, 5.1.3. for count, 5.3.2. for linear measure.]

Chapters 4 and 5 describe in detail the procedures necessary to determine whether weighing can be used to determine net contents conformance for packages labeled in units other than weight. Worksheets have been designed to take the inspector through all the steps necessary to convert to units of weight and back again. [See Chapter 4 for volume and Chapter 5 for length, area, and count.]

2.11.Tare

In compliance testing of packaged goods, the enforcement agency utilizes nondestructive tests insofar as possible and opens the fewest packages needed for adequate testing. The net weight of a package may be determined by weighing the unopened package -- called the "gross weight" -- and subtracting from that weight the average weight of the packaging materials, called the "average tare weight," provided that the actual tare weights of individual packages do not vary too much (see Section 2.11.4.). In more complicated situations, the official first determines whether the non-weight labeled unit of measure (e.g., volume) can be converted to a weight value (for example, by using the measured weight of a known volume). If this is possible, the net contents of a package can be determined by subtracting the tare weight from the gross weight, then converting the resultant value from units of weight to the units on the package label.[1]

The packages that are used to determine the average tare weight constitute the "tare sample." At least two individual packages should be used to obtain an average tare weight value (that is, the tare sample size should be at least two). For larger package samples, the average tare value should be obtained from more than two determinations. [See Tables 2-2 and 2-5, pages B-3 and B-5, column 3, for tare sample sizes corresponding to various package sample sizes.]

The average tare is recorded in box 13 on the report forms on page A-1 and A-2.

Two tare definitions are used commonly for the inspection of packaged goods:

a. **Unused tare** (also known as "dry tare") comprises all packaging materials (including glue, labels, ties, etc.) that will contain or enclose a product; it includes prizes, gifts, coupons, or decorations that are not part of the product. Unused tare is weighed before the product is introduced into the container.

b. **Used tare** comprises all packaging materials that can be separated from the packaged product, either readily (e.g., by shaking) or by washing, scraping, ambient air drying, or other techniques involving more than "normal" household recovery procedures, but not including laboratory procedures. As in the definition of unused tare, prizes, decorations and such are also part of the used tare.

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[1]In actual practice, a "nominal gross weight" value will be determined (and recorded in box 14 of the report forms shown on pages A-1 and A-2). The "nominal gross weight" is the sum of the average tare weight and the labeled weight. This weight value may then be easily compared with the actual gross weight of each unopened package remaining in the sample in order to arrive at the individual package errors. For example, see steps 5 and 6 of Section 3.5.

There are two subcategories of "used tare:"

- **Wet tare.** Used tare may also be called "wet tare" when no effort is made to reconstruct unused tare by drying out the absorbent portion of the tare. Free-flowing liquid is part of the wet tare for meat or poultry products from Federally-inspected plants. See Section 3.18.

- **"Dried used tare"** refers to used tare that has been air dried, or dried in some manner, to simulate the unused tare weight. See Section 3.18. for a further explanation of dried used tare.

In some cases (e.g., canned or glass- or plastic-packed goods), unused tare weights are equivalent to used tare (within the measurement precision of field test scales). However, the net contents value that is obtained when an unused tare weight is subtracted from the package's gross weight does not always represent the amount of product that can subsequently be recovered from the package. For example, oils or moisture from the product may be absorbed by the packaging material when in contact with the product, thereby increasing the weight of the packaging material and decreasing the weight of usable product after packaging.

Tare weight can vary considerably from package to package as compared with the variability of the package net contents, even for packages in the same production lot. Although this is not the situation for most packaged products, it is a major problem with glass or aerosol containers. Therefore, an "alternative tare determination" procedure is provided in Section 2.11.4. This procedure must be used for glass or aerosol containers and is optional for any other container. There are several instances in which this procedure will prove useful to the official; the method is so simple that it can be used routinely. For example, relatively heavy containers (e.g., plastic buckets or cans) can vary considerably in tare weight, especially in a retail store inspection lot, which may be composed of packages from more than one production facility, and with containers made of different materials or made by different manufacturers. The procedure of Section 2.11.4. will indicate if this tare variability is sizable in comparison with the net weight variability, and whether the official should open more packages to obtain the average tare weight.

Direct measurement of net contents is necessary when the product cannot be checked by weighing. [For example, packaging materials and individual units in packages labeled by "count" sometimes differ enough in weight from each other such that the gross weight of a package minus the tare weight may not adequately indicate the count of units inside the package.]

The direct measurement of net contents is also necessary when the net content is defined as the "drained weight" of product inside the package. "Drained weight" is prescribed by regulatory agencies in those instances in which it has been concluded that the only usable or consumable material inside the package is the solid portion, whereas the liquid portion is disposed of and therefore "drained away." Common examples are canned or bottled olives and mushrooms. The liquids in which they are packed are not considered part of the net contents. Drained weight procedures are provided in Sections 3.10. and 3.13.

(unless all the packages in the sample have been opened). The average tare weight is recorded in box 13 of the report form.

The actual gross weights of those packages that were opened for tare are compared with the nominal gross weight in box 14 to determine the package errors for the tare packages (and recorded in the spaces beside "d" and "e"). The nominal gross weight in box 14 is also used to compare against the sample packages not opened for tare. (See Chapters 3, 4, and 5.)

If the number of packages required to be opened for tare is more than half of the total sample, the official has the option of opening all the packages in the sample. The tare values are not averaged in such instances. Instead, each tare weight is subtracted from the corresponding package gross weight to obtain the individual package net weight.

It will be necessary to append worksheets to the report form if more than five packages must be opened.

Note: For foam product aerosols, a "test allowance" is applied to the tare determination to compensate for differences in product delivery between normal consumer usage and the test procedure. (See Section 3.11.6.) This test allowance (provided in Table 3-2, page B-17) is subtracted from the actual tare weight or the average tare weight. The test allowance is recorded in box 13a on page A-2. Also see Section 3.15. for corrections (box 13a) for canned coffee (vacuum pack). Moisture allowances can also be applied by means of a correction to the tare (and entered in box 13a).

2.12. MAV's[1]

The limits of reasonable individual package variations are called "MAV's" in this handbook. The MAV applies only to individual packages subject to the average requirement. Pressed and blown glass tumblers and stemware given an "allowable difference" (see Section 5.7.) are not compared with the MAV.

In the past, limits of reasonable variation have been described as values limiting both positive and negative deviations from the label. **The present handbook provides MAV's that are used to compare with minus package errors only.**[2] Positive deviations will in general be controlled by the competitive marketplace; this handbook, therefore, indicates MAV values that are intended to limit only negative deviations from the labeled quantity.

Tables 2-8 through 2-12, on pages B-9 through B-15, are separated according to the labeled unit of measure, for example, weight, volume, etc.

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[1]In addition, the average net contents of lots, shipments, or deliveries must equal or exceed the labeled net contents. The sampling plans of Category A or B are provided for testing packages subject to the average requirement.

[2]Note exception in Section 2.13 for textiles.

In each table, one column lists ranges of labeled quantities and another column lists the MAV for that range. For example, the MAV for a labeled weight of 5 lb can be found on page B-10. 5 lb is in the range "4.70+ to 5.80"; the MAV in decimal pounds is 0.14 and in ounces is 2 1/4. Two entries for each range of labeled weights are provided in Table 2-8 up to 1.08 lb. This will facilitate looking up the MAV for standard or random-pack packages. Standard-pack commodities up to 1 lb must be labeled in ounces; random-pack commodities will be labeled in decimal pounds.

When a MAV is listed as a percentage of the label, make the calculation and round down to the lower figure equivalent to the unit of measure. For example, fertilizer in 72 lb bags would have a MAV of 0.02 x 72 lb = 1.44 lb. If the scale being used to test the product has 0.1 lb divisions, the MAV would be recording as 1.4 lb and in dimensionless units as (1.4 lb/0.1 lb =) 14.

The MAV's for packages labeled by weight are limits to be applied to packages when the principal declaration on the label is in terms of net weight (e.g., soap) or drained weight (e.g., mushrooms). The MAV for packages labeled by weight do not apply to supplemental weight statements, such as "fill weight."

When checking standard pack packages, the official should complete box 3 of the report forms on pages A-1 or A-2 using that value from Table 2-8, 2-9, 2-10, 2-11, or 2-12 corresponding to the labeled quantity.

The special report form developed for random packages on pages A-3 and A-4 provides space for recording the MAV for random package weights in spaces below box 10 and 11. [See Section 3.8. for application of the MAV to random pack package lots.] Special worksheets provide space for calculating the MAV in units of weight and in dimensionless units for those instances in which weighing will be used to check packages labeled in units other than weight.

2.13. Exceptions to the MAV's[1]

MAV's exceeding those listed in Tables 2-8 through 2-12 must be applied for the products listed below.

Specific Product Exceptions to the MAV:

2.13.1. Polyethylene sheeting and film

2.13.1.1. Thickness

a. When labeled thickness is less than 1 mil (0.001 in), any individual thickness measurement of polyethylene film may be as much as 35% below the labeled thickness (i.e., at least 65% of the labeled thickness).[2]
(Added 1988)

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[1]In addition, the average net contents of lots, shipments, or deliveries must equal or exceed the labeled net contents. The sampling plans of Category A or B are provided for testing packages subject to the average requirement.

[2]ASTM Standard D-2103-86, "Standard Specification of Polyethylene Film and Sheeting," 1986.

b. When the labeled thickness is 1 mil or greater, any individual thickness measurement of polyethylene sheeting may be as much as 20% below the labeled thickness (i.e., at least 80% of the labeled thickness).[1]
(Amended 1988)

The average thickness of a single package of polyethylene sheeting may be as much as -4% below the labeled thickness (i.e., at least 96% of the labeled thickness).[2] [See Section 5.4.3.]

2.13.1.1. Weight

An individual package minus variation greater than 4% of the declared weight shall be considered unreasonable.[3]

2.13.2. Textiles

The National Conference on Weights and Measures Uniform Packaging and Labeling Regulation lists the MAV's for textiles[4] as the following:

a. For those packages with no declared dimension less than 24 inches (60 cm):

A minus error may be no larger than -3% of a declared dimension;
A plus error may be no greater than +6% of a declared dimension.

b. For packages with any declared dimension less than 24 inches (60 cm):

A minus error may be no larger than -6% of a declared dimension;
A plus error may be no greater than +12% of a declared dimension.

2.13.3. Mulch

The National Conference on Weights and Measures recommends the following MAV for mulch.[5]

A minus error may be no larger than -5% of the declared volume

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[1]ASTM Standard D-4397-84, "Specification for Polyethylene Sheeting for Construction, Industrial and Agricultural Applications," 1984.

[2]Section 10.12 (b) of the Uniform Packaging and Labeling Regulation, NIST Handbook 130, "Uniform Laws and Regulations."

[3]Section 10.13. of the Uniform Packaging and Labeling Regulation, NIST Handbook 130, "Uniform Laws and Regulations."

[4]Section 10.9.3. of the Uniform Packaging and Labeling Regulation, NIST Handbook 130, "Uniform Laws and Regulations."

[5]Section 10.11 of the Uniform Packaging and Labeling Regulation, NBS Handbook 130, "Uniform Laws and Regulations."

2.13.4. Meat or Poultry from Federally-Inspected Plants

The U.S. Department of Agriculture (USDA) sets the lower limit for individual packages for meat and poultry that are produced under official USDA inspection. These limits are defined according to the package's "group" and the scale division size being used by the packager. Table 2-12 on page B-15 defines the groups and the lower limits for individual packages. See Section 3.18. on how to use these MAV's.

2.14. Moisture Allowance

When it is necessary to allow for moisture loss, one possible procedure is to subtract an allowance value (converted to units of weight if necessary) from the nominal gross weight (see Section 2.11. and Section 3.5.) to obtain a "corrected nominal gross weight." The gross weight of each unopened package in the sample is then compared with the corrected nominal gross weight in order to determine individual package errors. The report form on page A-2 provides space in box 13a to record a moisture allowance in order to determine a corrected nominal gross weight (box 14). [See Figure 2-2.] This handbook does not provide specific allowance values to be used for moisture loss if box 13a is used.

See Section 3.17. (for flour) and Section 3.18. (for meat and poultry) for procedures using the "gray area" technique.

error in box 15. If the total error (box 15) is zero or a positive number, the lot passes the test. Compute the average package error by dividing the total error in box 15 by the sample size recorded in box 6. Record the average package error in box 18. Compute the average error in terms of weight by multiplying the average error in dimensionless units (recorded in box 18) by the unit of measure (recorded in box 2). Record that value in box 19. When following a Category B sampling plan, if the total (and average) error is negative, the lot fails the test. Record results in box 20 and the disposition of the lot in box 28.

11. When following a Category A sampling plan, if the total error is negative, "T" must be computed before a final decision on the lot can be made. See page H-3 for a completed example.

In order to compute "T":

- Record the range (R) of package errors of each group of five packages tested in the sample. Space is provided at the bottom of each column of five package errors to record the range.

- Average the group ranges and record the average range, $\bar{R}$, in box 21. [For a sample of 30, there will be 6 ranges to sum and divide by 6; for a sample of 50, sum 10 ranges and divide by 10.]

- Determine "d":

  d = Table 2-3, column 2 value multiplied by $\bar{R}$

Look up the value in Table 2-3, column 2 (page B-3) corresponding to the sample size (already recorded in box 6) and record this value in box 22. Multiply the value in box 22 by the average range in box 21 and record d in box 23.

- Compute the size of the sample as a percentage of the lot size. This is equal to the value in box 6 divided by the value in box 5 and multiplied by 100. Record the value in box 24. [For a sample size of 30 and a lot size of 300, this value is 10%.]

- Look up "f" in Table 2-4 (page B-4) corresponding to the percentage of lot sampled that was recorded in box 24. Record this value in box 25. [For 10% of the lot tested, f = .95.]

- Compute "T":

  T = d x f = the value in box 23 multiplied by the value in box 25.

  Record T in box 26.

12. Compare the magnitude of T (box 26) with the magnitude of the average error (box 18) (disregarding the fact that box 18 is a minus value). If the average error is larger than T, the lot fails to conform to the package requirements. If the average error is smaller than T, the lot conforms. Record the results in box 27 and box 28.

3.7. Standard Pack Labeled by Weight: Alternative Tare

The CORE METHOD (Section 3.5.) is followed except:

a. The sample packages are kept in the order in which their corresponding random numbers were obtained.

b. The random tare sample is the "initial tare sample" and is selected from the random sample.

c. Tare weights are determined by emptying, cleaning, and weighing all packaging materials.

d. The range of tare weights (R_t) and range of net weights (R_c) is determined for the initial tare sample.

e. R_c/R_t is computed and this value is used to look up how many more packages (if any) must be opened to determine tare. Additional tare packages are measured as necessary.

f. Package errors are determined for the tare sample and for the rest of the sample by comparison with the nominal gross weight.

The procedure is as follows. Differences from the CORE METHOD are underlined. See Figure 2-9 for an example of part of the completed report form.

1. Fill out the report form identifying the product, container description, location of test, and other pertinent data, including:

   - the labeled weight (box 1),
   - the unit of measure (box 2),
   - the MAV corresponding to the labeled weight (box 3) and
   - the MAV converted to dimensionless units (box 4).

   Determine the inspection lot size (record in box 5). Record:

   - sample size[1] (box 6), and
   - allowed number of unreasonable errors (box 8).

   Determine and record initial tare sample size from Table 2-6 (page B-6) in box 7.

2. Select random sample from inspection lot keeping sample packages in the order in which their corresponding random numbers are obtained. This is the order in which packages will be opened for tare determination. [See Appendix E.6.1. for an example.]

3. Determine and record individual package gross weights (in boxes labeled a) for initial tare sample.

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[1]For Category A, see page B-3. For Category B, see page B-5.

Regulations under the Fair Packaging and Labeling Act[1] require that, in the case of packages designed to deliver the product under pressure, ". . . the declaration shall state the net quantity of the contents that will be expelled when the instructions for use as shown on the container are followed."

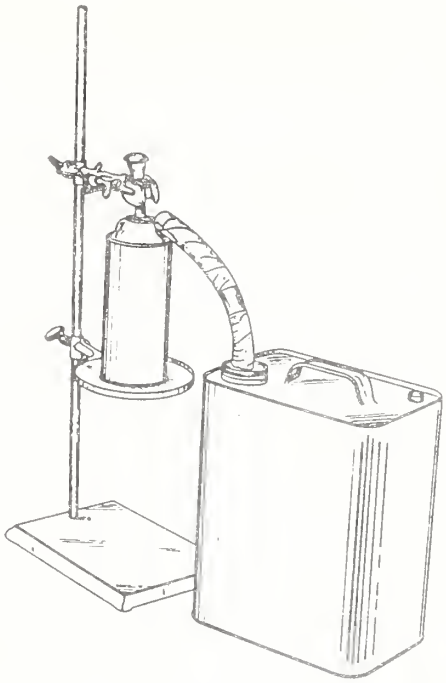

Figure 3-10. Portable test stand for aerosol paints and coatings.

The procedure presented below may be used for checking aerosol net contents when labeled by weight.

1. Fill out the heading of the standard pack report form (page A-2) and select the random sample. As explained in Appendix E.6.1., the random sample should be arranged in the order in which the random numbers were selected. This will be the order in which the packages will be opened for tare. Consult Table 2-6, page B-6, for the size of the initial tare sample.

2. Gross weigh each package in the initial tare sample and record this weight on the report form in the boxes labeled a. Follow Section 3.11.4. to empty the initial tare sample aerosol containers.

After following Sections 3.11.4., go on to Section 3.11.5. for instructions on completing the procedure.

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[1]Regulations under the Fair Packaging and Labeling Act (PL 89-755) include 16CFR 500.22(a), 21CFR 701.13(g)(1), 21CFR 201.62(f), and 21CFR 101.105(g). Also see parallel requirements recommended by the National Conference on Weights and Measures in its Uniform Packaging and Labeling Regulation (Section 10.2) in NBS Handbook 130. Quotations above from 21CFR 101.105(g).

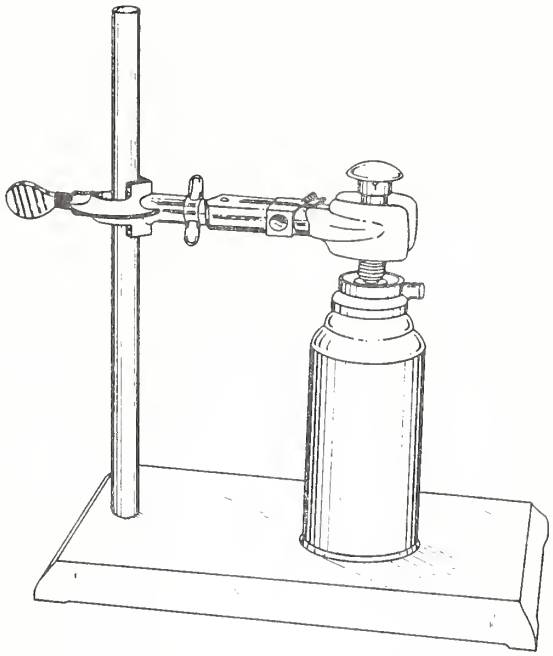

Figure 3-11. Portable test stand showing aerosol foam product ready to expel to in upright position.

3.11.4. Exhausting the Aerosol Container

Follow the procedures below to empty aerosol containers and thereafter determine their tare.

Do not shake unless shaking is specified. If shaking is specified, shake according to directions on the container. If no directions are given as to how the can should be shaken, shake the container with a brisk wrist-twisting motion for one minute at the approximate rate of two wrist-twisting cycles per second. If the container has a ball agitator, continue shaking procedure for one minute after the ball has shaken loose.

a. Foam products:[1] Shake container according to directions on the can. Placing the selected container in the position specified in the instructions on the package, exhaust it by holding the valve wide open until visible spray is interrupted. Continue exhausting container for 30 seconds. If using portable test stand (see Figures 3-11 and 3-12), exhaust container following the above procedures. However, hold valve wide open for 30 minutes.

(Revised 1990)

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[1]A foam product is defined as a product that forms a foam at the container valve or on impingement with a surface and the foam volume is not substantially reduced for at least 20 seconds. Examples of foam products: shave creams, hand creams, facial foams, shampoos, oven cleaners, upholstery cleaners, foam degreasers, whipped toppings, frosted whips.

For example, if a moisture loss of 3% is found for a 2-lb lot of flour, this is a weight loss of 0.06 lb (2 lb x 3 x 0.01).

If the moisture loss (in item 15) is equal to or larger than the amount of shortage found for the average error (in item 9), then the lot can be accepted. If the moisture loss is less than the average shortage, then the lot should be rejected and further enforcement action taken.

For example, assume the average package error for a 2-lb lot of packages is 0.05 lb. If a moisture loss of 3% is found, the weight loss of 0.06 lb (2 lb x 0.03) is more than the amount of shortage (0.05 lb), therefore, the lot would pass the average requirement. Record this in Item 16.

Similarly, if any individual minus package errors exceed the MAV and place the lot into the gray area, add the amount of weight lost due to moisture loss (Item 15) to the largest individual minus package error (recorded in Item 10). If the resulting package error is still larger than the MAV (see Table 3-3, third column), the lot should be rejected. If the resulting package error is smaller than the MAV, the lot should be accepted. Record this in Item 17.

For example, if the largest individual package error for a lot of 2-lb packages is -0.08 lb, this puts the lot into the gray area, even if the average package error is zero or plus. If a moisture loss of 3% is found, the weight loss of 0.06 lb added to the individual package error makes the package error -0.02 lb (-0.08 lb + 0.06 lb). The MAV for 2-lb package lots is -0.07 lb, so this lot passes if the average is zero or plus.

3.17.4. Moisture Content Laboratory Test

a. Equipment

- Forced-air (or equivalent) laboratory convection oven
- Desiccator and drying agent
- Analytical balance
- Drying dishes with covers
- Calibrated thermometer
- Tongs or insulated gloves

b. Procedure

1. Set oven to 130 + or - 3 °C. Let temperature stabilize.
2. Weigh at least three empty drying dishes and covers for each lot of flour being tested (that is, run a triplicate).
3. Weigh covered dishes with about 2 g flour in each one.
4. Uncover dishes, place them in the oven.

5. Start timing for 1 hour from the time the temperature returns to 130 °C.

6. Cover the dishes, transfer them to a desiccator, and weigh after the dishes return to room temperature.

7. Compute the moisture content (%) =

$$\frac{\text{flour weight before drying} - \text{flour weight after drying}}{\text{flour weight before drying}} \times 100$$

8. Average the results on three dishes for each lot.

Exchange samples with flour milling plant in order to determine whether their laboratory results are equivalent to yours.

3.18. Meat and Poultry from Federally-Inspected Plants

3.18.1. Background for Administrator and Inspector

These test procedures are for meat and poultry coming from Federally-inspected plants. If inspectors check these packages at wholesale or retail, and use Category A sampling plans from H-133 and either unused or dried used tare (see Section 3.18.3.5. for definition), the tested packages are either in or out of compliance: there is no gray area. If a jurisdiction uses wet tare (see Section 2.11. Tare, for definition), there is a "gray" or "no-decision" area. **The gray area is not a tolerance. If packages are found in the gray or no-decision area, they neither automatically pass nor fail the test. If lots are tested and found inside the gray area, they are not necessarily in compliance. The jurisdiction will have to do more work to find out the final status of the lot.**

Jurisdictions wishing to perform wet tare tests upon products for which no gray area has yet been determined will need to permit "reasonable variations" until a gray area has been determined for that product. New gray area determinations will be printed in the Federal Register. Contact the USDA Regional Office for a listing of the products that have gray areas, as well as the size of their gray area percentages.

The size of the gray area is defined as a percentage of the labeled weight that extends downward from the labeled weight.

a. Enforcement action inside and outside the gray area

The overall objective is to test packages as closely as possible to a routine test. However, one difference will immediately be apparent:

Category A (Table 2-2) sampling procedures must be employed at retail or wholesale locations when testing packages put up in a Federally-inspected plant. (This is because a test similar to a Category B test has already been run on the packages at the plant level.)

Category B (Table 2-5) sampling procedures may be used when testing at the packaging plant.

b. "Dry Tare" Jurisdictions

For jurisdictions that normally utilize unused tare to test meat and poultry packaged at a retail store, it will be necessary to simulate unused tare for packages from Federally-inspected plants by drying out absorbent materials (if any) comprising the used tare and to determine a "dried used tare."

No additional information will be needed other than the results of a Category A test using "dried used tare" before taking enforcement action on lots.

c. "Wet Tare" Jurisdictions

For jurisdictions that normally use wet tare, if the package lots are found short weight with wet tare tests, but fall in the "gray area," it is necessary to collect additional information to determine whether or not the lot complies with net weight requirements.

If the package lots are found short weight using a Category A sampling plan and wet tare, it will first be necessary to determine whether the lot is inside or outside the gray area. If the lot falls in the gray area, additional information will have to be collected before reaching a final determination whether the lot is in or out of compliance. Of course, nothing additional will be needed for lots that fall outside the gray area. Appropriate enforcement should be taken on packages found short weight and outside the gray area.

A "hold" or a "stop sale" order should be put on packages found short weight, but inside the gray area, until their status can be determined. If this is not possible, the strongest legal remedy should be sought if the product cannot be held and subsequent tests or information indicates that the lot is out of compliance.

d. Which packages to consider as part of the lot being tested

Ordinarily, an inspector taking a sample from retail will record lot codes, but will not select the lot for test by sorting the packages by lot code. He or she will simply select a sample from all packages of the same brand and style and size on the shelf or in the stock room. If short weight is found and the results are in the gray area (wet tare only), follow-up investigation requires sorting the lot codes at this point.

e. Category A sampling plans must be used for all tests

See Section 3.18.3. for details. The discussion below is based on using these procedures and on recording the "package errors" -- how much and in what direction the actual package weight differs from the labeled weight. Thus, if a package labeled 2 lb actually weighs 2.010 lb, its package error is +0.010 lb. Similarly, the "average package error" is the difference between the average weight of the sampled packages and the labelled package weight. If the average of 10 package weights is 1.994 lb, the average package error is (1.994 - 2,000 lb) = -0.006 lb.

f. Package lots must meet the average requirement and the individual requirement

When checking packages not subject to possible moisture loss and using Category A sampling plans, two requirements must be met:

(1) The average net weight of the sample must equal or exceed the labeled net weight minus an adjustment factor called T,[1] which represents the possible deviation between the sample average and the actual lot average.

If a jurisdiction applies either unused or used dried tare to meat and poultry packages, this is sufficient to determine whether the average requirement has been met. See Figure 3-15.

If a jurisdiction uses wet tare, an amount defined by the gray area must be considered before determining noncompliance of the lot under test without further information or data collection. See Figure 3-16.

The size of the gray area has been set at 3% of the average labeled weight for raw, fresh poultry, and 2-1/2% of the labeled weight for franks and hot dogs (whether made from meat or poultry).

(2) The number of packages that may fall below the MAV is specified in Category A sampling plans according to the sample size. Ordinarily, the inspector uses Table 2-8 to look up the MAV for packages labeled by weight.

USDA Meat and Poultry Inspection uses a set of MAV's for products under its supervision. These are given in Table 2-12. Use Table 2-12 for all products coming from a Federally-inspected plant.

The size of the gray area must be added to the individual package limits specified in Table 2-12 when the jurisdiction uses wet tare.

g. What to do when the lot is in the gray area ("Wet Tare" Jurisdictions Only)

Contact the USDA Regional Director or the Inspector-in-charge at the packaging plant (see Section 3.18.3.h.) to determine what information (either USDA's or the plant's) is available at the plant to clarify the status of the lot in question. General guidelines are given in Section 3.18.3.h.

According to the location of the plant, either visit the plant, or call and ask the weights and measures authorities where the plant is located to visit and test.

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[1]See the general discussion of T in Chapter 2 and in NCWM Training Module 10.

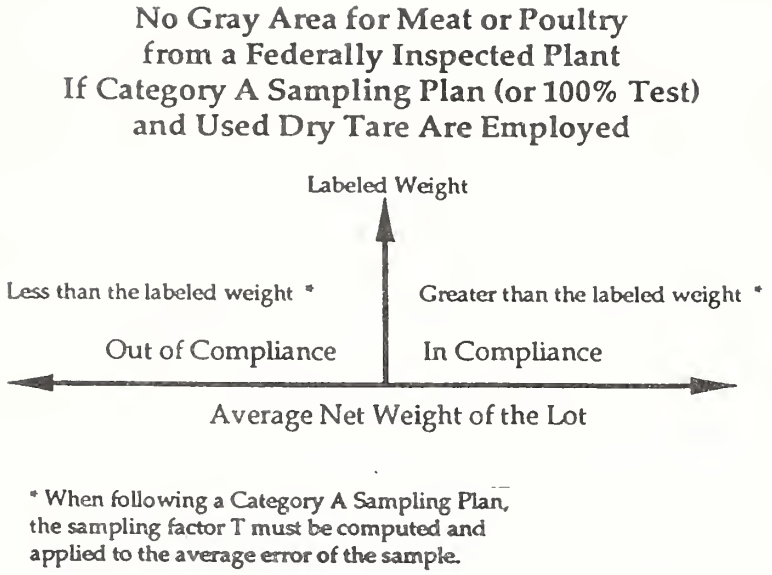
No Gray Area for Meat or Poultry
from a Federally Inspected Plant
If Category A Sampling Plan (or 100% Test)
and Used Dry Tare Are Employed
Labeled Weight
Less than the labeled weight *
Greater than the labeled weight *
Out of Compliance
In Compliance
Average Net Weight of the Lot
* When following a Category A Sampling Plan,
the sampling factor T must be computed and
applied to the average error of the sample.

Figure 3-15.

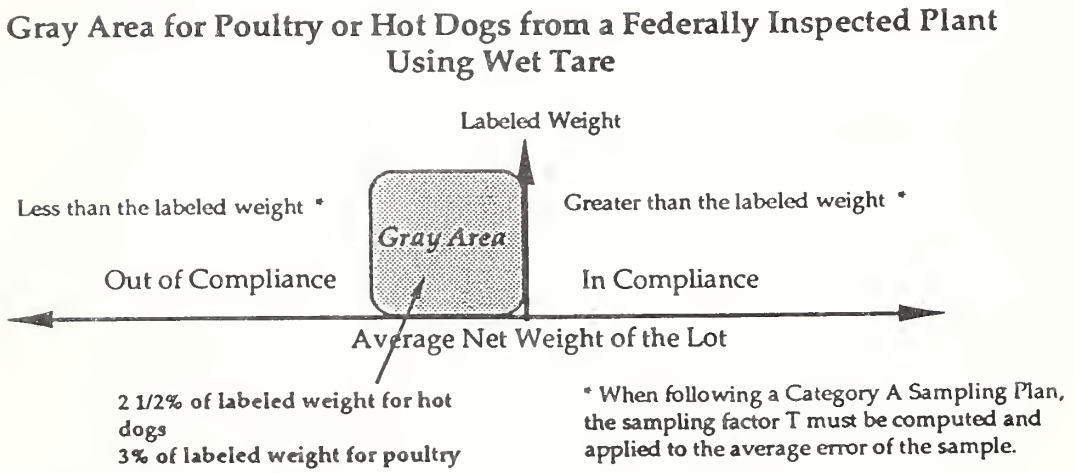
Gray Area for Poultry or Hot Dogs from a Federally Inspected Plant
Using Wet Tare
Labeled Weight
Less than the labeled weight *
Gray Area
Greater than the labeled weight *
Out of Compliance
In Compliance
Average Net Weight of the Lot
2 1/2% of labeled weight for hot
dogs
3% of labeled weight for poultry
* When following a Category A Sampling Plan,
the sampling factor T must be computed and
applied to the average error of the sample.

Figure 3-16.

3.18.2. Types of Products

a. Bacon

There should be no free-flowing liquid in packaged bacon. Wet tare and dried used tare are equivalent. Wipe all packaging materials dry of fat and clinging moisture before weighing tare. There is no gray area for bacon.

b. Fresh Sausage and Luncheon Meats

There is no gray area for fresh sausage or luncheon meats (for example, bologna). Carefully clean and wipe all tare materials. Wet tare and dried used tare are equivalent.

c. Franks/Hot Dogs

A gray area of 2-1/2% of the labeled weight is to be applied when wet tare tests are conducted.

d. Fresh Poultry

A gray area of 3% of the average labeled weight of the sample is to be applied when wet tare tests are conducted.

3.18.3. Procedure

a. Field Equipment

Use Scales and Weights recommended in Section 3.1.

b. Report Forms

Use either the Standard Pack-Weight Only-Report Form (page A-2) or the Random Pack Report Form (pages A-3 and A-4). Record the official establishment number from the USDA logo in the space provided underneath name and address.

c. Selection of Lots

Refer to Section 2.3. for defining and selecting the inspection lot. The lot codes are the packer's own identifying marks, not the universal product code (UPC). In many instances, the lot code may be represented by a "pull" or "sell by" date. Record the lot code on the report form.

d. Sample Size

Select the sample according to the size of the inspection lot following a Category A sampling plan (Table 2-2, page B-3). Do not sort random-pack packages from lightest to heaviest as recommended in Section 3.8.1., step 2.

If an average tare weight and nominal gross weight were determined:
Package error = package gross weight - nominal gross weight

f. The Average Requirement

Compute the average error for the sample. Sum all individual package errors and divide by the number of packages in the sample. Record the average package error in box 18 on the standard pack report form or box 20 on page 2 of the random pack report form.

If the average error is zero or plus, the lot complies with the average requirement.

If the average error is minus, first compute T[1] (see Section 2.7. in this handbook and Chapter 6 of the Inspector's Manual in Module 10 for further instructions if this procedure is unfamiliar to you). Record T on the report form, and continue with subsections (1), (2), or (3) below as appropriate.

(1) Unused or Dried Used Tare

With dried used tare, if the average minus error is larger than T, the lot does not comply with the average requirement; enforcement action should be taken. Also, follow the process outlined in Section 3.18.3.g.

(2) Wet Tare - Fresh Poultry

(a) Compute 3% of the average labeled weight.

average labeled weight x 0.03 = gray area

There is space below column 8 of the Random Pack Report Form to compute the average labeled weight of the sample.

(b) Record this in the comments section as "gray area."

(c) If T was computed, add the gray area to T, calculated and recorded on page 2 of the random pack report form. Record in remarks section as "gray area + T".

(d) Compare value in box 20 with "gray area + T".

(e) If the value in box 20 is larger than the "gray area +T", the lot fails to comply. (Since box 20 will always have a minus value -- or else you would not have calculated T --, disregard the sign when comparing with gray area + T.) If the value in box 20 is between T and the gray area + T, go to Section 3.18.3.h. If the value in box 20 is less than T, the lot complies.

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[1]Unless the lot is so small that the inspector is testing all packages in the lot (100% test). If this is the case, and the average error is minus, the lot fails if it is a dried used tare test; the lot may be in the gray area if it is a wet tare test.

(3) Wet Tare - Hot Dogs or Franks

(a) Compute 2-1/2% of the labeled net weight recorded in box 1 of the standard pack report form.

(value in box 1) x 0.025 = gray area (lb or oz)

(b) Convert to dimensionless units by dividing by the unit of measure in box 2.

$$\frac{\text{gray area (lb or oz)}}{\text{box 2}} = \text{gray area (dimensionless units)}$$

Record this in comments section as "gray area."

(c) Continue with (c), (d), and (e) as for Subsection (2), Wet Tare - Fresh Poultry.

g. The Individual Package Requirement

Table 2-12 gives the limits for individual package errors for packages produced at Federally-inspected plants. Use this table instead of Table 2-8 for looking up the MAV. The number of individual minus package error permitted to be larger than the "lower limit for individual weights" (see the righthand column of this table) is given in Table 2-2 (page B-3). Convert this value (or values if a random pack lot falls between groups) to dimensionless units and record on the report form.

When conducting a dried used tare test, compare the value(s) from Table 2-12 (converted to dimensionless units) with the minus package errors. If the number of minus package errors that exceed the limits of Table 2-12 is more than allowed by the Category A plan being followed, the lot does not comply.

Wet Tare

When conducting a wet tare test on hot dogs or fresh poultry, the size of the gray area must be added to Table 2-12 value(s) before counting the number of packages that exceed the MAV. In Section 3.18.3.f. the size of the gray area (in dimensionless units) was recorded in the comments area of the report form. The values from Table 2-12 are recorded in boxes 10 and 11 on the random pack report form and box 4 on the standard pack report form. Add the size of the gray area to the value(s) from Table 2-12 (converted to dimensionless units) before comparing with the minus package errors.

If the number of minus package errors that are greater than (Table 2-12 + the gray area) exceeds the number permitted in Category A plans, the lot does not comply. If minus package errors fall between the Table 2-12 value and (Table 2-12 + the gray area), they place the lot in the gray area if the number of these types of minus package errors exceeds the number permitted in Category A plans.

If the ratio is greater than 0.05 in step 8, the remaining volume of liquid is:

$$\frac{\text{weight difference (step 12) x labeled volume}}{\text{weight of labeled volume for each package}}$$

(Or Method B, Section 4.6.2., may be followed.)

Record remaining volume in the package on the worksheet.

14. Add the volume remaining in the package as determined in step 13 to the volume poured from the package (determined in step 9 and recorded on the worksheet) to arrive at the total volume.

Total product volume =

volume delivered into flasks or graduates +
volume remaining in package.

15. Subtract the labeled volume from the total package volume determined in step 14 to arrive at the individual package error.

Package error (units of volume) =
(total product volume) - (labeled volume).

Record package error on the worksheet and in the crosshatched area of the report form (identifying an appropriate unit of measure in box 2).

16. Repeat steps 9 through 15 above for the second package opened. If the ratio calculated in step 8 is 0.05 or smaller, the average weight of the labeled volume may be used (already calculated in step 8).

If the ratio calculated in step 8 is greater than 0.05, the weight of a known volume of product from this package would already have been determined in Step 5 of Section 4.4. This weight of a known volume can be used in step 13 above for this package only.

17. If the ratio calculated in step 8 is 0.05 or smaller, open each package in the sample, deliver its contents into flask(s) and a graduate as described in step 9 above, and repeat steps 10 through 15 using the average weight of the labeled volume already determined in step 8. Repeat for every package in the sample.

If the ratio calculated in step 8 above is greater than 0.05, determine the weight of a known volume as described in Section 4.4. for each of the remaining packages in the sample following each determination with steps 9 through 15 above.

After package errors for sample have been determined, follow steps 7-11 of Section 3.5. (CORE METHOD) to determine lot conformance.

c. Example

From a sample labeled "40 fl oz" the first package was opened and part of the product was poured into a 1-qt flask to the 1-qt mark.

The remaining product was then poured into a 1/2-pt flask and was found to fill the flask to 1/2 fl dr below the 8-fl oz mark.

Therefore, the volume delivered from the package is

= 32 fl oz + 8 fl oz - 1/16 fl oz
= 39.9375 fl oz delivered.

The weight of the wet package container is 1.012 lb and after air drying, 1.000 lb. According to procedures followed in steps 3 and 5 of Section 4.4., it was found for the two tare sample packages that 32 fl oz weighs 2.123 lb (average weight).

Thus,

$$\frac{(1.012 \text{ lb} - 1.000 \text{ lb}) \times 32 \text{ fl oz}}{2.123 \text{ lb}} = 0.18 \text{ fl oz.}$$

This is the volume of product remaining in the package.

Therefore, the total product volume is:

39.94 fl oz + 0.18 fl oz = 40.12 fl oz.

The package error is:

40.12 fl oz - 40.00 fl oz = +0.12 fl oz.

4.6.4. Method D: Determining the Net Contents of Compressed Gas in Cylinders

See page 4-46.

4.7. Milk

Because of the homogeneity of milk within a production lot, some steps in Section 4.4. are eliminated if the inspector is careful to define the inspection lot as that product from a single production lot code.

Equipment is the same as described in Section 4.2. except that the selected flask may be equal in volume to that declared on the milk container.

4.16. Fresh Oysters Labeled by Volume

Packaged fresh oysters removed from the shell are required to be labeled by volume, for example, "8 fl oz" or "1 gallon." In addition, the maximum amount of permitted free liquid is 15% by weight. Testing the quantity of contents of fresh oysters therefore requires a determination of total volume, total weight of solids and liquid, and the weight of the free liquid only.

Ordinarily, the contents of a package labeled by fluid volume can be poured into an inspector's field flask to determine the fluid volume (with an appropriate correction given for clingage remaining in the package). This can be done when testing gallon-size containers or larger. However, oysters will not fit through necks of the smaller field flasks. Therefore, the procedure below determines the package net volume by measuring the volume of water delivered to the package container when filled to the same level as the original oyster contents. Determining the amount of free liquid requires draining the oysters and weighing the free liquid drained away. Worksheets are provided with the following method.

4.16.1. Equipment

- Small-capacity package testing scale
- Depth gauge
- Bubble level
- Field flasks and graduate
- No. 8, 8-inch U.S. Standard sieve and receiving pan for small packages; 12-in sieve for 1-gallon containers
- Rubber spatula, rubber gloves, (mask, hair net, hard hat, as required under health and safety codes.)
- Stopwatch

4.16.2. Procedure

Every package in the sample must be opened. The following steps apply to each package:

1. Gross weigh the package. Record the weight on a worksheet.
2. Set the package container on a level surface. Open container. Use depth gauge to determine the level of fill. Lock depth gauge. Mark location of gauge on the package.
3. Weigh a dry 8-inch or 12-inch receiving pan. Record the weight in box e on the worksheet. Set sieve over receiving pan.

4. Empty contents from package container onto sieve. Do not shake. Tip the sieve slightly to help it drain. Time drain for 2 minutes. Remove sieve with oysters. A mucous is often associated with the oysters and will not go through the sieve. This is natural. Do not force the mucous through the sieve.

5. Weigh the receiving pan and liquid. Record the weight in box d. Subtract the weight of the dry receiving pan from the weight of pan and liquid to obtain the weight of free liquid. Record the weight in box f.

6. Wash and wipe the package container (as necessary) and weigh it dry. Record the weight in box b. This is the tare weight of the package. Subtract the tare weight recorded in box b from the gross weight recorded in box a to obtain the total weight of the oysters and liquid. Record this total weight in box c.

7. Determine percent of free liquid by weight as follows:

$$\text{Percent of free liquid by weight} = \frac{\text{weight of free liquid}}{\text{weight of oysters + liquid}} \times 100.$$

Record percentage in box g.

8. Set up depth gauge on dry package container exactly as in step 2.

9. Deliver water from flasks and graduate as needed to re-establish the level of fill in step 2. Record all volumes in part II of the worksheet in boxes h through k. Sum all volumes. This is the actual net volume for that package.[1]

[1]Some containers will hold the declared volume only when filled brim full; they may have been designed for ice-cream or similar products, rather than for oysters. If a shortage is found in the net volume (per step 9), determine whether the container used to package the product will contain the volume only if filled to the brim. Under such circumstance, the package net volumes will all be short measure because the container cannot be filled to the brim with a solid and liquid mixture such as oysters. A minimum head space is needed (space between the liquid level and the lid) in order to get the lid onto the container without losing any liquid.

Worksheet for Determining Net Volume of Oysters and Percent of Free Liquid

I. Amount of Free Liquid

a. Package gross weight	
b. Package tare weight	
c. Weight of receiving pan and liquid = a - b =	
d. Weight of receiving pan and drained liquid	
e. Weight of dry receiving pan	
f. Weight of free liquid = d - e =	
g. Percentage of free liquid = $\frac{f}{c} \times 100 =$	

II. Net Volume

Establish the level of fill of package containing oysters using depth gauge.
Re-establish the level of fill using water and depth gage set to same depth as oyster liquid level.
Record below the amount(s) of water needed to re-establish liquid level.

h. Flask size	
i. Flash size	
j. Graduate	
k. Graduate	
l. TOTAL VOLUME = Sum all volumes recorded above =	

4.6.4. Method D: Determining the Net Contents of Compressed Gas in Cylinders

These procedures are for industrial compressed gas.

Compressed gas may be labeled by weight (for example, LP gas or carbon dioxide) or by volume. Acetylene, liquid oxygen, nitrogen, nitrous oxide, and argon are all filled by weight, but acetylene is sold by cubic feet or by liters and the other products listed are sold by liters. Helium, gaseous oxygen, nitrogen, air, and argon are filled following pressure and temperature tables. Checking the net contents of compressed gas cylinders depends on the method of fill: those filled by weight may be checked by weight. It is unnecessary to connect the cylinder to anything, but it may be necessary to move the cylinder to weigh it. In addition, it may be necessary to schedule testing over a 2-day period if acetylene is to be checked: it takes from 10 to 12 hours to fill acetylene cylinders. Once the tare weight has been determined, it will require another day to test filled cylinders for which the tare weight is known.

Those cylinders filled by using pressure and temperature charts must be tested by connecting a pressure gauge to the cylinder and determining the pressure and temperature.

Safety is a primary concern with all testing procedures.

a. Safety

Anyone handling a compressed gas cylinder must be made aware of the hazards of high pressures found with any compressed gas. Untrained or partially trained individuals should not be allowed to handle compressed gas.

It is essential that anyone handling a cylinder of gas or cryogenic liquid be certain of the contents before connecting the cylinder to anything. Discharging a gas or cryogenic liquid through a system for which the material is not intended could result in damage due to the incompatibility of the system and the product. A fire and/or explosion could result from such a mistake.

Before connecting a cylinder to anything, be certain of the following:

1. The cylinder is clearly marked or labeled with the name of the contents and that there are no conflicting marks or labels. Do not rely on the color of the cylinder to identify the contents of a cylinder.

2. The marked or labeled contents are all correct.

3. The cylinder is provided with the correct Compressed Gas Association (CGA) connection(s) for the product.

4. The connection(s) on the cylinder properly fits the system. A proper connection will go together smoothly. Do not use excessive force. Do not use an adaptor to connect oxygen to non-oxygen cleaned equipment.

5. Personnel moving or using cylinders are trained and knowledgeable regarding the product, cylinder, fittings, and proper procedures. See CGA pamphlet P-1 "Safe Handling of Compressed Gases in Containers," for additional information.

Warning! Failure to observe the precautions above is reported to have caused fatalities.

b. Additional Safety Warnings

1. The inspector must have a thorough knowledge of the procedure, with emphasis on safety precautions, before attempting any tests. Charts referred to in the procedure should not be furnished to inspectors until the necessary training has been completed.

2. The inspector must be extremely careful with all gases since some react violently when mixed or when coming in contact with other substances. For example, oxygen reacts violently when it comes in contact with hydrocarbons.

3. Always wear safety glasses when testing cylinders by the temperature-pressure method.

4. When moving a cylinder, always place the protective cap on the cylinder. Do not leave spaces between cylinders when moving them. This can lead to a "domino" effect if one cylinder is pushed over.

5. When a cylinder valve is opened to measure the internal pressure, position your body **away** from the pressure gage blowout plug or in front of the gauge if the gauge has a solid cast front case. If the bourdon tube should rupture, you do not want to be in a position to receive serious injuries from gas pressure or fragments of metal.

6. Open all valves slowly. A failure of the gauge or other ancillary equipment can result in injuries to nearby persons. Remember: high gas pressure can propel objects with **great** force. Gas ejected under pressure can also cause serious bodily injuries if someone is too close during release of pressure.

7. One of the gauges shall be reserved for testing oxygen only and shall be prominently labeled "For Oxygen Use Only." See 4.6.4. (c) 2. This gauge must be cleaned for oxygen service and maintained in that "clean" condition.

8. The other gauge(s) may be used for testing a variety of gases if they are compatible with one another.

9. Special precautions must be observed with flammable gas in cylinders, in addition to the several precautions necessary for the safe handling of any compressed gas in cylinders.

   Contrary to general practice with other gas cylinders, do not "crack" cylinder valves of flammable gas before connecting them to a regulator or test gauge. This is extremely important for hydrogen or acetylene.

10. Additional precautions necessary for personal safety are described in the CGA Handbook of Compressed Gases. All personnel testing compressed gases should have this manual for reference and be familiar with its contents.

c. Equipment

1. Scale, calibrated weights, and ramp.

2. Two (2) calibrated precision bourdon tube gauges or any other approved laboratory-type pressure-measuring device that can be accurately read within plus or minus 5 psi. A gauge having scale increments of 25 psi or smaller shall be considered as satisfactory for reading within plus or minus 5 psi. The range of both gauges shall be a minimum of 0 to 5000 pounds per square inch when testing cylinders with standard industrial cylinder valve connections. Standard industrial cylinder connections are those connections listed in CGA Standard V-1, Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections,[1] for use with gas pressures up to 3000 psig (20 680 k Pa). For testing cylinders with cylinder valve connections rated for over 3000 psig, the test gauge and its inlet connection must be rated at 2000 psig over the maximum pressure that the connection is rated for in CGA V-1. (Note that there are standard high pressure industrial connections on the market that are being used up to their maximum pressure of 7500 psig.)

   Any gauge or connectors used with oxygen cylinders must be cleaned for oxygen service, transported in a manner which will keep them clean and **never** used for any other gas including air or oxygen mixtures. Oxygen will react with hydrocarbons and many foreign materials and can result in fire or explosion.

3. An approved and calibrated electronic temperature measuring device or three calibrated mercury-in-glass thermometers having either a digital readout or scale division of no more than 1 degree. The electronic device equipped with a surface temperature sensor is preferred over a mercury-in-glass thermometer because of its shorter response time.

4. Safety glasses.

5. Two wrenches. Box wrenches of 1 1/8 inch for oxygen, nitrogen, carbon dioxide, argon, helium, and hydrogen and 7/8 inch for some sizes of propane. All industrial CGA connections are limited to these two hex sizes. Use of an adjustable wrench should be avoided because of the tendency to round the edges of the fittings which can lead to connections not being tightened properly.

6. It is best to use a separate gauge and fitting for each gas to be tested. If adaptors must be used, be sure that they are never used on oxygen systems.

d. Procedure

Containers must be labeled in compliance with NIST Handbook 130 requirements. Containers which do not bear a labeled statement of identity, responsibility, and net quantity should be marked "off sale" until the containers are brought into compliance.

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[1]"Standard For Compressed Gas Cylinder Valve Outlet and Inlet Connections," Compressed Gas Association, 1235 Jefferson Davis Highway, Arlington, VA 22202.

1. Testing by Weight

   (a) The cylinder is stamped or stenciled with a tare weight. This is a safety feature that assists the filling plant in many of its filling operations. It may or may not be the weight used by the filling plant when determining the net weight of those cylinders sold or filled by weight. If there is a tare weight marked on the net contents tag or directly on the cylinder, then an actual tare weight was determined at the time of fill. If there is no tare weight marked on a tag or on the cylinder, then the stamped or stenciled tare weight was used to determine the net contents. When the stamped or stenciled tare weight is used in net contents determinations, the inspector should check the accuracy of the stamped tare weights. The actual tare weight must be within
   (1) 1/2 percent of the stamped tare weight for 20 lb tare weights or less, or
   (2) 1/4 percent of the stamped tare weight for greater than 20 lb tare weights.

   (b) Place cylinder on scale.

   (c) Remove protective cap. The cap is not included in the tare weight. The tare does include acetone when acetylene cylinders are tested.

   (d) Weigh the cylinder and determine net weight. Compare actual net weight with labeled net weight or use the actual net weight to look up the correct volume declaration and compare that with the labeled volume.

   (e) The acetone in acetylene cylinders is included in the tare weight of the cylinder. Therefore, as acetylene is withdrawn from the cylinder, some acetone will also be withdrawn, changing the tare weight. Most producers will replace acetone in the cylinder before the cylinder is refilled, filling the cylinder with acetone to the stamped tare weight. Other producers, although not following recommended procedures, do not replace the acetone until it drops to a specified weight. In the latter situation, the refilling plant must note the actual tare weight of the cylinder and show it on the tag containing the net content statement or on the cylinder itself.

   (f) Refer to tables for acetylene gas if necessary (that is, if the acetylene is billed by the cubic foot). See (d) above.

2. Volumetric Testing

   (a) Thermometers or temperature sensors used for measuring temperatures during testing of cylinder gases shall be in contact with the outside surface of the cylinder approximately at the midpoint of the longitudinal axis.

   (b) The cylinders to be tested for quantity shall be taken from a lot that has had time to stabilize at the ambient temperature. Normally, the outside row of cylinders should not be selected for testing since they may be of a different temperature. The temperature used shall be an average taken from three cylinders selected at random. Cylinders that are exposed to heat or sunlight shall not be chosen for test unless an electronic heat sensor is used to measure the temperature of each cylinder. This is the preferred method of measuring the cylinder temperature because there can be differences in temperature from

cylinder to cylinder, and the electronic sensors will stabilize within a few seconds. It is not practical to measure the temperature of each cylinder with a mercury-in-glass thermometer due to the time required for the thermometer to stabilize.

(c) Measure the pressure of each cylinder in the sample selected.

(d) Determine the temperature of the cylinders in the sample selected.

(e) Determine the cylinder nominal capacity from cylinder data table or from cylinder manufacturer.

(f) Refer to NIST Tech Note 1079 and compute the actual net content.[1]

[1]"NBS Technical Note 1079," U.S. Department of Commerce, National Institute of Standards and Technology, Gaithersburg, MD 20899.

5.1.3. Possible-Violation Procedure

Special worksheets have been developed to accompany the report form. The worksheets on pages A-9 and A-10 guide the inspector through the procedure. See pages H-14, H-15, and H-16 for a completed example.

The measurement of the weight of the number of units in the package is combined with the determination of tare and, therefore, will not require opening more packages than the tare sample.

If the procedure in Section 5.1.2. has been used, procedure 5.1.3. can be followed with the same sample if package contents have been kept separate and can still be counted.

1. Determine inspection lot, fill out the report form heading (page A-1), and select the random sample and random tare sample. Record the labeled count in box 1 on the report form.

2. Gross weigh the packages selected for tare determination and record their gross weights in item 1 of the worksheet. Open these packages.

3. Determine and record the net package contents weight and the exact number of items in the first opened package.

   Record the weight in item 4 and the count in item 3 on the worksheet.

4. Record the MAV from Table 2-10 (page B-13) in units of count in box 3 on the report form and in item 6 on the worksheet.

   In order to determine whether the scale used to weigh the packages is able to discriminate differences in count, calculate the weight equivalent to MAV/6. MAV/6 must be at least as large as 1/2 the size of the smallest scale division (or at least as large as the smallest increment in the read-out on a digital scale). [See items 7 and 8 on worksheet.]

   For example, from Table 2-10 the MAV is 7 units for a package labeled with a count of 250 units. The scale should be capable of discriminating differences corresponding to MAV/6 or, in this example, one unit.

   If the criterion above is not met, count the package contents in each package in the sample; if met, go on to step 5.

5. Determine and record the tare weight of the first package opened on the worksheet in item 2.

6. Determine and record the weight and the count of the package contents in the second package opened for tare (items 3 and 4 on the worksheet).

7. Calculate the weights of the labeled counts for the first two packages.

$$\text{Weight of labeled count} = \text{labeled count} \times \frac{\text{contents weight}}{\text{contents count}}$$

   Record these weights in item 5 of the worksheet.

To avoid round-off errors, carry over at least two extra decimal places in the calculation until the weight of the labeled count is obtained.

The difference in weights of the labeled counts of the two packages must not exceed the value given in Table 4-3 (page B-20). Fill in item 9 on worksheet.

If the difference in weights does not meet this criterion, determine the actual count per package for every package in the sample. If the difference meets this criterion, average the weights of the labeled count and go on to step 8.

8. Determine the tare for the rest of the tare sample if any additional tare sample packages remain. Record the tare values on the worksheet. Average the tare weights (record in item 10 on the worksheet and box 13 on the report form).

9. The average weight of the labeled number of items in the package (step 7) plus the average tare weight (step 8) equals the "nominal gross weight". Record the nominal gross weight on the worksheet in item 11 and in box 14 on the report form.

   Package error (weight) =

   (actual package gross weight) - (nominal gross weight)

   Record package errors for the tare sample packages (items 12 and 13 on the worksheet).

10. Convert the MAV to units of weight,

    MAV (weight) =

$$\text{MAV (count)} \times \frac{\text{average weight of labeled count}}{\text{labeled count}}$$

    See item 14 on worksheet for calculation.

    Convert the MAV to dimensionless units and record in box 4 of the report form and item 15 on the worksheet.

    With all measurements converted to weight and dimensionless units, go to Step 6-11 of Section 3.5. (CORE METHOD) to determine lot conformance. Convert back to count when completing box 19 of the report form by following the calculation in item 16 on the worksheet.

5.2. Packages Labeled by Count When the Labeled Count Is 50 or Fewer Units per Package

A special sampling plan is provided for packages labeled by count when the number of units per package is 50 or fewer. The sampling procedure requires counting the number of units in each package in the sample and noting the number of those packages that contain less than the labeled count. The MAV is not used directly in the sampling

5.3.2. Procedure

1. Determine inspection lot, fill out the standard pack report form on page A-1, and select the random sample and tare sample. Separate report forms and worksheets (replacing all "count" terms with "dimensions" on page A-9 and A-10) should be filled out for packages labeled by separate dimensions and/or area.

2. Gross weigh and open the packages selected for tare determination. Record on the worksheet in item 1.

3. Determine the measurements (to the nearest division of the appropriate tape or rule) of the packaged goods (length, width, area--depending upon which dimensions are declared on the label) and weigh the goods from the first package opened for tare determination.

   Record the weight and measure on the worksheet in items 4 and 3. Calculate the weight of the labeled measurement on the worksheet following item 5.

   Weight of the labeled measurement =

   $$\text{labeled measurement} \times \frac{\text{contents weight}}{\text{contents measurement}}$$

   Record the MAV in units of length or area measure (given in Table 2-11, page B-14) in box 3 of the report form and on the worksheet in item 6.

4. Calculate the length or area of packaged product corresponding to MAV/6 and convert the MAV/6 to units of weight as shown in item 7 of the worksheet. MAV/6 in units of weight must be at least as large as 1/2 of the smallest division on the scale used to weigh the product (or at least as large as the smallest increment in the readout, if a digital scale is being used).

   For example, an inspector finds that 200 sq ft of product weighs 2.000 lb; 1 sq ft must therefore weigh 0.010 lb. For the small capacity scale, this is 5 times the usual minimum scale division (0.002 lb); therefore, the first criterion is met. [See item 8 on the worksheet.]

   If this criterion is met, go on to the next step. If not, all packages in the sample must be opened in order to measure the contents.

5. Determine and record in item 2 on the worksheet the tare weight of the first package opened.

6. Determine the measurements of the product in the second package chosen for tare determination (item 3). Determine the tare weight of this package and record on the worksheet (item 2). Calculate and record the weight of the labeled measurement for the second package (item 5).

7. The weights of the labeled measurement for two packages must not differ by more than the value given in Table 4-3 (page B-20). If they do, all packages in the sample must be opened, measured individually, and compared

against the labeled measure to determine the package errors. [See item 9 on the worksheet.] If Table 4-3 criterion is met, go on to step 8.

8. Calculate the average weight of the labeled measurement and record it on the worksheet in item 9.

9. Determine the tare weights of the rest (if any) of the tare sample. Record on the worksheet and average the tare weights (item 10 on the worksheet).

10. The average weight of the labeled measurements (item 9 on the worksheet) plus the average tare weight (item 10 on the worksheet) equals the nominal gross weight. Record the nominal gross weight on the worksheet in item 11 and in box 14 on the report form.

    Package error (weight) =

    (actual package gross weight) - (nominal gross weight)

11. Determine the package errors for the tare sample following the arithmetic in items 12 and 13 on the worksheet and transfer these values to the cross-hatched area of the report form.

12. Convert the MAV to units of weight.

    $$\text{MAV (weight)} = \frac{\text{avg. wt. of label measurements x MAV (length)}}{\text{labeled measurements}}$$

    Record MAV in units of weight on the worksheet in item 14.

    Convert the MAV to dimensionless units in item 15. With all measurements converted to weight, follow steps 6-11 of Section 3.5. to determine lot conformance. Convert package errors in weight to length (or area) when completing the report form using the formula in step 16 on the worksheet.

5.4. Polyethylene Sheeting

Polyethylene sheeting is sold not only by its linear or area measurement and net weight, but also by its thickness. The procedure to check thickness is based on ASTM D374, "Standard Test Methods for Thickness of Solid Electrical Insulation."

First the net weight of the product and dimensions of the sheeting are checked. If the net weight and dimensions conform to the package requirements, the thickness of the sheeting is then checked. [This portion of the procedures does not follow a decision chart.] All the sample packages are opened for thickness measurements.

A worksheet is provided to record length, width and thickness measurements for polyethylene sheeting on page A-11.

5.4.1. Equipment

Scales and weights recommended in Section 3.1.

Micrometer:

- A deadweight dial micrometer (see Figure 5-1) equipped with a flat anvil, 1/4-in (6-mm) diameter or larger, and a 3/16-in (4.5-mm) diameter flat surface on the head of the spindle. The anvil and spindle head surfaces should be ground and lapped, parallel to within 0.0001 in (0.002 mm), and should move on an axis perpendicular to their surfaces. The dial spindle should be vertical and the dial should be at least 2 in (50 mm) in diameter. The dial indicator should be continuously graduated to read directly to 0.0001 in (0.002 mm). If capable of making more than one revolution, it must be equipped with a separate indicator to indicate the number of complete revolutions. The dial indicator mechanism should be fully jeweled. The frame should be of sufficient rigidity that a load of 3 lb (13 N) applied to the dial housing, exclusive of the weight or spindle presser foot, will not cause a change in indication on the dial of more than 0.001 in (0.02 mm).

  The indicator reading must be repeatable to 0.00005 in (0.0012 mm) at zero setting.

  Weight on probe head (total of anvil, weight, spindle, etc.) must be 4 oz (113.6 g).

- Electronic or motor-driven comparator with same specifications as above.

Steel tape rules recommended in Section 5.3.1.

T-square.

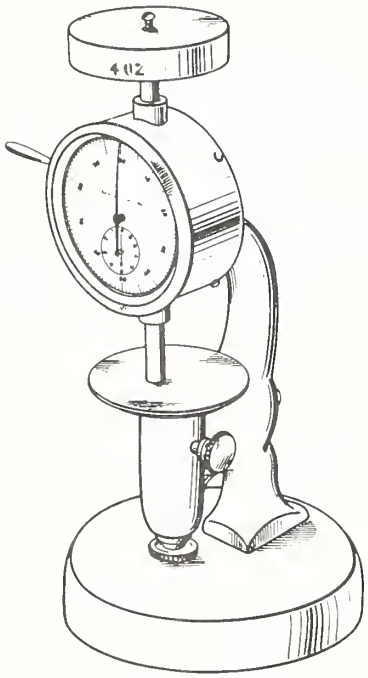

Figure 5-1. Deadweight dial micrometer.

5.4.2. Preparation for Test

Gage blocks covering the range of thicknesses to be tested should be used to check the accuracy of either the micrometer or the comparator and should be maintained without rust, tarnish, or scratches. The micrometer or comparator should be operated in an atmosphere free from drafts and fluctuating temperature and should be allowed to stabilize at ambient room temperature before use.

Place the deadweight dial micrometer or comparator on a solid, level table, free from excessive vibration. Check the weight of the deadweight used with the spindle head. It should have a weight of about 3.6 oz.

If the dial does not read zero with nothing between the anvil and the spindle head, set it at zero. Raise and lower the spindle head or probe several times; it should indicate zero each time. If it does not, find and correct the cause before proceeding. The accuracy of the micrometer or comparator should be checked with appropriate thickness gages whenever the device is moved to a different location and at the beginning of each day's use of the device.

5.4.3. Procedure

Steps 3a and 6a below apply to rolled product, steps 3b and 6b to folded product. Steps 8a and 8b apply to a two-stage MAV and, therefore, both steps 8a and 8b are followed for any single product test.

1. Determine inspection lot, fill out the standard pack report form heading (page A-1), and select the random sample and random tare sample.

   Check the label declaration to make sure that all the declared dimensions are consistent with one another:
   W = T x A x D x 0.03613, where
   W = net weight in pounds
   T = nominal thickness in inches
   A = nominal area; that is, nominal length in inches times nominal width in inches
   D = density in grams per cubic centimeter as determined by ASTM Standard D1505-68 "Standard method of Test for Density of Plastics by the Density Gradient Technique" (or latest issue).
   0.03613 is a factor for converting g/cm^3 to lb/in^3.
   Use the density (D) of 0.92 g/cm^3 in the calculation.[1]

The labeled weight should be equal to or greater than the weight calculated.

For example, if the label reads:

6 ft x 100 ft
4 mil
net weight 11.1 lb

[1]See Section 2.12.4., Uniform Regulation for the Method of Sale of Commodities, NIST Handbook 130.
Alternative formula: **weight (pounds) = 0.0047865 x length (ft) x width (ft) x thickness (mils)**

$$W = (.004 \text{ in}) \times (100 \text{ ft} \times 12 \frac{\text{in}}{\text{ft}})$$

$$\times (6 \text{ ft} \times 12 \frac{\text{in}}{\text{ft}}) \times 0.03613 \times 0.92 = 11.49 \text{ lb net weight}$$

Therefore, a declaration of 11.1 lb indicates that the label is not in compliance.

Separate report forms for weight, length, width, and thickness should be attached to one another. The MAV for length and width dimensions is found in Table 2-11, page B-14. The MAV's for weight and thickness are listed in Section 2.13. and in steps 4, 8a and b below. [If the actual length and width are correct, the area declaration is assumed correct.]

2. Gross weigh the packages chosen for tare, open them, and record the gross weights on the report form.

3. Weigh the first package tare (include core if any) and record on report form. Extend the first package to its full dimensions, and remove by hand all creases and folds as far as possible.

   Measure the length and width of the product to the closest 1/8 in (3 mm). Make all measurements at intervals uniformly distributed along the length and width of the product. Record the individual measurements on the worksheet for polyethylene. Compute the average length and width and record on the worksheet.

   a. With rolls of product, make three length measurements along the width of the roll and at least ten width measurements along the length of the product.

   b. For folded products (such as drop cloths or tarpaulins), make three length measurements along the width of the sample and three width measurements along the length of the sample.

4. Follow Section 3.6. for determining conformance of the lot with net weight labeling requirements, but use an MAV of 4% of the labeled weight. If the lots fail to conform with net weight requirements, no further measurements are necessary.

5. Follow steps 4 through 12 of Section 5.3.2. to determine whether the inspection lot conforms with the package requirements on length and width. If the lot fails to conform, thickness need not be checked.

6. Measure the thickness of the plastic sheet with a micrometer or comparator at:

   a. Five uniformly distributed locations across the width at each end and 5 locations along each side of each roll in the sample, or;

   b. Five uniformly distributed locations across the width at one end and along the length at one side of folded product for each package in the sample.

When measuring the thickness, place the sample between the micrometer or comparator surfaces and lower the spindle head or probe near, but outside, the area where the measurement will be made. Raise the spindle head or probe a distance of 0.0003 to 0.0004 in (0.008 to 0.01 mm) and move the sheet to the measurement position. Drop the spindle head onto the test area of the sheet. Read the dial thickness 2 seconds or more after the drop, or when the dial hand or digital readout becomes stationary. This procedure minimizes small errors that may occur when the spindle head or probe is lowered slowly onto the test area.

For succeeding measurements, raise the spindle head or probe 0.0003 to 0.0004 in (0.008 to 0.01 mm) above the rest position on the test surface, move to the next measurement location, and drop the spindle head onto the test area. Take care to raise the spindle head or probe no more than 0.0004 in or 0.01 mm above its rest position on the test area. Any part of the test area in contact with the spindle head or probe during measurement must be at least 1/4 in or 6 mm from the edge of the sheet.

Record all thickness measurements on the worksheet. Compute and record the average thickness for the individual package.

7. Repeat step 6 on the remaining packages in the sample.

8. In Section 2.13., the MAV for polyethylene was described to apply in two stages. Follow both a and b below.

   a. No measured thickness of polyethylene labeled 1 mil or greater should be less than 80% of the labeled thickness.

      No measured thickness of polyethylene labeled less than 1 mil should be less than 65% of the labeled thickness.

   Circle any value in the thickness columns of the worksheet that is smaller than (0.8 x labeled thickness) [or 0.65 x label if thickness is less than 1 mil]. If the number of values circled exceeds the number recorded in box 8 of the report form, the lot fails to conform to requirements. No further testing of the lot is necessary.

   If the number of circled thickness measurements is less than or equal to the box 8 value, go on to step 8b.

   b. The average thickness for any single package should be at least 96% of the labeled thickness. This is an MAV of 4%.

      Circle any package <u>average thickness value</u> that is smaller than (0.93 x labeled thickness).

      If the number of package average thicknesses circled[1] exceeds the number recorded in box 8 of the report form, the lot fails to con-

[1]Count circled average thicknesses only; do not include circled individual thicknesses in this count.

Table 2-8. MAV's for an individual package labeled by weight[a]

Avoirdupois Units			Metric Units	
Labeled Weight	MAV		Labeled Weight	MAV
Pounds or Ounces	Decimal Pounds	Fractional Ounces	Grams	Grams
up to and including 0.08 lb up to and including 1.28 oz	10% of labeled weight		up to and including 36	10% of labeled weight
0.08+[b] to[c] 0.12 lb 1.28+ to 1.92 oz	0.008	1/8	36+ to 54	4
0.12 to 0.18 lb 1.92+ to 2.88 oz	0.012	3/16	54+ to 82	5
0.18+ to 0.26 lb 2.88+ to 4.16 oz	0.016	1/4	82+ to 118	7
0.26+ to 0.34 lb 4.16+ to 5.44 oz	0.020	5/16	118+ to 154	9
0.34+ to 0.46 lb 5.44+ to 7.36 oz	0.024	3/8	154+ to 209	11
0.46+ to 0.58 lb 7.36+ to 9.28 oz	0.028	7/16	209+ to 263	13
0.58+ to 0.70 lb 9.28+ to 11.20 oz	0.032	1/2	263+ to 318	15
0.70+ to 0.84 lb 11.20+ to 13.44 oz	0.036	9/16	318+ to 381	16
0.84+ to 0.94 lb 13.44+ to 15.04 oz	0.040	5/8	381+ to 426	18
0.94+ to 1.08 lb 15.04+ to 17.28 oz	0.044	11/16	426+ to 490	20
1.08+ to 1.26 lb	0.048	3/4	490+ to 572	22
1.26+ to 1.40 lb	0.052	13/16	572+ to 635	24
1.40+ to 1.54 lb	0.056	7/8	635+ to 698	25
1.54+ to 1.70 lb	0.060	15/16	698+ to 771	27

[a] Applies only to shortages in package weight (that is, the MAV is compared with minus package errors only)

[b] 0.08+ means "greater than 0.08"

[c] "to" means "to and including"

See Section 2.13 for polyethylene

Table 2-8. (continued) MAV's for an individual package labeled by weight[a]

Avoirdupois Units			Metric Units	
Labeled Weight	MAV		Labeled Weight	MAV
Pounds or Ounces	Decimal Pounds	Fractional Ounces	Grams or Kilograms	Grams
1.70+ to 1.88	0.064	1	771+ to 8.52	29
1.88+ to 2.14	0.070	1 1/8	852+ to 971	32
2.14+ to 2.48	0.078	1 1/4	971+ to 1.125	35
2.48+ to 2.76	0.086	1 3/8	1.125+ to 1.350	40
2.76+ to 3.20	0.094	1 1/2	1.350+ to 1.600	45
3.20+ to 3.90	0.11	1 3/4	1.600+ to 1.800	50
3.90+ to 4.70	0.12	2	1.800+ to 2.100	55
4.70+ to 5.80	0.14	2 1/4	2.100+ to 2.640	65
5.80+ to 6.80	0.15	2 1/2	2.640+ to 3.080	70
6.80+ to 7.90	0.17	2 3/4	3.080+ to 3.800	80
7.90+ to 9.40	0.19	3	3.800+ to 4.400	85
9.40+ to 11.70	0.22	3 1/2	4.400+ to 5.200	100
11.70+ to 14.30	0.25	4	5.200+ to 6.800	115
14.30+ to 17.70	0.28	4 1/2	6.800+ to 8.20	130
17.70+ to 23.20	0.31	5	8.20+ to 10.60	145
23.20+ to 31.60	0.37	6	10.60+ to 14.30	170
31.60+ to 42.40	0.44	7	14.30+ to 19.25	200
42.40+ to 54.40	0.50	8	19.25+ to 24.70	230
54.40+	2% of labeled weight		24.70+	2% of labeled weight

Table 2-12. U.S. Department of Agriculture, Meat and Poultry, Groups and Lower Limits for Individual Packages

Group Name	Definition of Group (numbers are labeled weight in ounces)		Lower Limit for Individual Weights (Use the limits according to the scale division being used)
	Homogeneous, Fluid when Filled	All Other Products	
A	less than 3	less than 3	10% of labeled weight
1	3 - 16		7.1 g 0.16 lb 0.25 oz 8/32 oz 4/16 oz 2/10 oz 2/8 oz 1/4 oz
2	over 16	3 - 7	14.2 g 0.031 lb 0.50 oz 16/32 oz 8/16 oz 5/10 oz 4/8 oz 2/4 oz
3		over 7 to 48	28.3 g 0.062 lb 1 oz
4		over 48 to 160	42.5 g 0.094 lb 1.50 oz 1 16/32 oz 1 8/16 oz 1 5/10 oz 1 4/8 oz 1 2/4 oz
5		over 160	1% of labeled weight

Table 3-1. Recommended maximum units of measure to be used in recording package weights

Avoirdupois			Metric units	
Labeled weight	Units of measure (oz avoir)	(lb)	Labeled weight	Units of measure (kg)
Up to and including 1.92 oz (0.12 lb)	a	a	Up to and including 82 g	a
Greater than 1.92 oz (0.12 lb) to and including 5.44 oz (0.34 lb)	1/32[b]	0.002[b]	Greater than 82 g to and including 250 g	0.001[b]
Greater than 5.44 oz (0.34 lb) to and including 20 oz (1.25 lb)	1/16	0.004	Greater than 250 g to and including 900 g	0.002
Greater than 1.25 lb to and including 4 lb	1/8	0.008	Greater than 900 g to and including 2.5 kg	0.005
Greater than 4 lb to and including 8 lb	1/4	0.02	Greater than 2.5 kg to and including 30 kg	0.01
Greater than 8 lb to and including 25 lb	1/2	0.02	Greater than 30 kg to and including 60 kg	0.05
Greater than 25 lb to and including 50 lb	1	0.05	Greater than 60 kg	0.1
Greater than 50 lb to and including 150 lb	4	0.2		
Greater than 150 lb	8	0.5		

[a] An analytical or other high accuracy balance will be necessary for weighing packages in this category.

[b] The equal-arm package scale must be used as null-indicator for packages labeled from 1.92 to 5.44 oz or 82 to 250 g to eliminate effects of possible tower errors.

APPENDIX C. GLOSSARY

ACCEPTANCE TOLERANCE.[1] The limit of inaccuracy for new, newly reconditioned, or adjusted equipment. [See Section 3.1.]

ALLOWABLE DIFFERENCE. The amount by which the actual quantity in the package may differ from the declared quantity. Pressed and blown tumblers and stemware labeled by count and capacity are assigned an allowable difference in capacity. [See Section 5.7.]
Also termed Tolerance.

ANALOGUE SCALE. A weighing device in which weight values are indicated by means of "a series of graduations in combination with an indicator, or in which the most sensitive element of an indicating system moves continuously during the operation of the device."[1] [See Section 3.9.]

AUDIT TESTING. Preliminary tests designed to quickly potential noncompliance. [See Section 1.5.]

AVERAGE. The sum of a number of individual measurement values divided by the number of values. For example, the sum of the individual weights of 12 packages divided by 12 would be the average weight of those packages.

AVERAGE ERROR. The sum of the individual package errors (defined) (considering their arithmetic sign) divided by the number of packages comprising the sample. [See Section 2.6.2.]

AVERAGE REQUIREMENT. [See Section 1.2.1.]

AVERAGE TARE. The sum of the weights of individual package containers (or wrappers, etc.) divided by the number of containers or wrappers weighed.

AVOIRDUPOIS UNITS. The inch-pound unit (defined) for weight commonly used in the United States of America, based on the pound of 16 ounces and the ounce of 16 drams.

BERRY BASKETS AND BOXES.[1] Disposable containers in capacities of 1 dry quart or less for berries and small fruits.

BREAK POINT. That point at which a digital indicator changes its indication from one value to an adjacent value. [This is determined by adding test weights 0.1 of the value of the smallest indication until the break point is reached.] [See Section 3.9.]

CATEGORY A (CATEGORY B). A set of sampling plans provided in this handbook for use in checking packages that must meet the average requirement (defined). [See Section 2.6. for Category A, and Section 2.7. for Category B.]

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[1]NIST Handbook 44.

CHECKWEIGHER. A weighing device often used in packaging operations. It separates packages into weight groups according to the amount their actual weights differ (over or under) from the target or nominal weight.

COMBINATION QUANTITY DECLARATIONS.[1] A package label that contains the count of items in the package as well as one or more of the following: weight, measure, or size.

COMPLIANCE TESTING. The determination of conformance of packages with specified legal requirements.

CORRECTED AVERAGE TARE. For foam product aerosols (defined), this is the average tare (defined) as measured minus the test allowance (defined). [See Section 3.11.6. and Table 3-2.]

DECISION CRITERIA. The rules for deciding whether or not a lot is in conformance with package requirements based on the results of checking the packages in the sample. [See Sections 2.6.1., 2.6.2., 2.7.1., and 2.7.2.]

DELIVERY. A quantity of identically labeled product received at one time by a buyer.

DIMENSIONLESS UNITS. The integers in terms of which the official records package errors. The dimensionless units must be multiplied by the unit of measure (defined) to obtain package errors in terms of weight, length, etc. [See Section 2.9.1.]

DISPOSABLE CONTAINERS. A package container designed to be used only once.

DIVISION[2] (on a scale). For a mechanical scale: the smallest subdivision of the scale. For a digital (electronic) scale: the difference between two consecutively indicated values.

DRAINED WEIGHT. The weight of solid or semisolid product representing the contents of a package obtained after a prescribed method for removal of the liquid has been employed. [See Section 3.10 and 3.13.]

DRIED USED TARE. Used tare (defined) that has been air-dried, or dried in some manner to simulate the unused tare weight. [See Section 3.18.]

DRY MEASURE. Rigid containers designed for general and repeated use in the volume measurement of particulate solids.

DRY TARE. Unused tare.

ERROR. See PACKAGE ERROR.

FILL WEIGHT. A supplemental statement of the weight of solids put into the package (usually canned food) but before further processing. It is <u>not</u> the same as a drained weight statement.

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[1]NIST Handbook 130, Uniform Method of Sale of Commodities Regulation.

[2]NIST Handbook 44.

STANDARD PACK. That type of package in which a commodity is put up with identical labels and only in certain specific quantity sizes. Examples of goods so packed are canned, boxed, bottled and bagged foods, and over-the-counter drugs.

SUBSTITUTION WEIGHING. The use of a commercial scale as a "null indicator" (defined). The weight of the package or product is determined by using the official's test weights (defined), the commercial scale serving merely as an indicator for a "zero" or load balanced condition and not as an indicating device. [See Section 3.9.]

SUPPLEMENTARY QUANTITY DECLARATIONS.[1] "The required quantity declaration may be supplemented by one or more declarations of weight, measure, or count, such declaration appearing other than on a principal display panel. Such supplemental statement of quantity of contents shall not include any terms qualifying a unit of weight, measure, or count that tends to exaggerate the amount of commodity contained in the package (e.g., 'giant' quart, 'full' gallon, 'when packed,' 'minimum,' or words of similar import)."

SURVEY TESTING. See audit testing.

TAPE RULES.[2] Flexible steel linear measures.

TARE WEIGHT. The weight of a container, wrapper, or other material (see discussion in Section 2.11.) that is deducted from the gross weight to obtain the net weight.

TARE SAMPLE. The packages or packaging material used to determine the average tare weight. [See Section 2.11.]

TARE SAMPLE SIZE. The number of packages or packaging material units used to determine the average tare weight. [See column 3 of Tables 2-2 or 2-5.]

TEST ALLOWANCE. An allowance made to compensate for differences in delivery of foam aerosol packaged products between normal consumer usage and the test procedure. [See Section 3.11.6.]

TEST WEIGHTS. Weights of known value used to check the accuracy of package quantities and scales (also used in substitution weighing). [See Section 3.1.]

TOLERANCE. A value fixing the limit of allowed departure from the labeled contents; usually presented as a (+) and a (-) value. [See Sections 1.2.2. and 5.7.]

UNIT OF MEASURE. An increment of weight, length, or volume chosen so that an inspector may record package errors in terms of small integers. [The package errors are actually the integers multiplied by the unit of measure.] [See Section 2.9.1.]

UNREASONABLE ERRORS. Minus package errors that exceed the MAV (defined). [See step 7 of Section 3.5.] The number of unreasonable errors permitted in a sample is specified by the sampling plan.

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[1]16 CFR §500.20

[2]NIST Handbook 44.

UNUSED TARE. All packaging materials (including glue, labels, ties, etc.) that contain or enclose a product, including prizes, gifts, coupons, or decorations that are not part of the product. Unused tare is weighed before the product is introduced into the container.

USED TARE. All packaging materials that can be separated from the product, either readily (e.g., by shaking) or by washing, scraping, ambient air drying, or other techniques involving more than "normal" household recovery procedures, but not including laboratory procedures. Prizes, decorations, and the materials that are not part of the product are included in the used tare. See also "wet tare" and "dried used tare."

VALVE ACTUATOR (VALVE BUTTON). The push button located on the top of the aerosol package that controls the flow of product by means of a valve.

VAPOR TAP VALVE. A push button aerosol delivery device that will expel product whether the container is in the upright or inverted position.

VOLUMETRIC MEASURES. Standard measuring flasks, graduates, cylinders, etc. for use in the measurement of volumes of liquids. [See Section 4.2.]

WET TARE. Used tare (defined) when no effort is made to reconstruct unused tare weight by drying out the absorbent portion (if any) of the tare. Free-flowing liquid is part of the wet tare for meat or poultry products from Federally-inspected plants. See Section 3.18.

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